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THESIS

THE CREDIBILITY OF THE
SUPPLY DEPARTMENT IN THE
MAINTENANCE ENVIRONMENT

by

David Neal Doyle

December 1987

Thesis Advisor: R. Evered

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This thesis examins the credibility of the supply department within the maintenance environment. Data for the analysis was obtained by surveying commanding officers and Supply Corps officers of 312 maintenance-related Navy activities. The surveys were distributed under report control number OPNAV-4400-4(OT). Each population was analysed independent of the other. The conclusion of this research is based on a comparison of that independent analysis and shows that the supply department within the maintenance environment has a significant credibility gap.

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The Credibility of the Supply Department in the Maintenance Environment

by

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1987

ABSTRACT

This thesis examines the credibility of the supply department within the maintenance environment. Data for the analysis was obtained by surveying commanding officers and Supply Corps officers of 312 maintenance-related Navy activities. The surveys were distributed under report control number OPNAV-4400-4(OT). Each population was analyzed independent of the other. The conclusion of this research is based on a comparison of that independent analysis and shows that the supply department within the maintenance environment has a significant credibility gap.

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I. INTRODUCTION

A. BACKGROUND

The credibility of the supply department in the maintenance environment is crucial. The supply department is responsible for major logistic support elements which are integral to sound maintenance decisions. A loss of commanding officer confidence in the supply department can result in less-than-optimum maintenance procedures. Worse yet, the loss of confidence will likely force maintenance personnel to devise unique support avenues and bypass established lines of supply logistics support. Even so, the author has not found a single study which attempts to measure the level of confidence that either the commanding officer or the supply officer within the maintenance environment has in the supply department.

B. OBJECTIVES

The first objective of this thesis is to measure and report the level of confidence the commanding officer of a maintenance-related activity has in his supply department. Chapter II presents this work. The second objective is to measure and report the level of confidence the supply officer of that same activity has in the supply department. This presentation is found in Chapter III.

Indirectly, this thesis reports on the credibility of the Supply Corps officer. After all, the Supply Corps officer is the functional head of the supply organization within the maintenance activity. He gives his supply organization direction. He sets departmental priorities. He is the role model for his department.

C. THE RESEARCH QUESTION

Does the supply department within the maintenance environment have a credibility gap?

D. SCOPE AND LIMITATION

Within the framework of this thesis, a maintenance environment is defined as:

(1) Any afloat activity which is assigned a Supply Corps Officer

(2) Any ashore activity which has a maintenance-related primary mission and is assigned a Supply Corps officer who is responsible for the supply logistics support of that activity

This study does not consider the impact which the environment outside of the local maintenance activity has. For example, wholesale provisioning or stocking policies may impact onboard supply logistic support, but these policies are outside the boundaries of this thesis. Rather, this research surveys how the supply department performs within the narrow bounds of the local maintenance environment.

E. ASSUMPTIONS

First, this research assumes that both commanding officers and Supply Corps officers can quantify 13 subjective measures of "level of confidence". These measures are referred to as "factors" throughout this report. They are found in Appendices A and B. Specifically, the factors are survey questions I through U. Second, the analysis of variance in this report assumes populations are independent in relationship, normal in distribution, and equal in variance.

F. METHODOLOGY

1. Sampling Methodology

Two surveys were used to get sample data from two populations of officers within the maintenance environment. Appendix A was used to get data from commanding officers; Appendix B was used to get data from Supply Corps officers. Appendices A and B are identical in that they solicit the same information from the respondents. Both the commanding officer and the supply officer of each activity surveyed were requested to complete the applicable surveys. These activities were selected at random from a list of "maintenance activities" taken from the Navy Standard Distribution List.

2. Survey Design

Survey questions A through C specify the primary groups of commanding officers and Supply Corps officers.

Sub-groups of each primary group not only include those within-group ranks identified by questions A through C, but also include those within-group ranks identified by questions D through F and questions V through Y.

Survey questions I through U identify the subjective factors which commanding officers and Supply Corps officers are asked to quantify. Those factors are:

(I) Timeliness in responding to customer needs

(J) Accuracy of the departments's records and reports

(K) Degree to which promises made are kept

(L) Level of professional skill within the department

(M) Degree of favorable interface with customer departments

(N) Degree to which stated department goals support command goals

(O) Degree to which department actions support command goals

(P) Level of positive morale within the department

(Q) The department's openness to change

(R) The department's commitment to customer service

(S) Degree of advanced planning (rather than crisis management) done within the department

(T) Degree to which the department is consistent in its performance

(U) Level of confidence held in the department

Of all the factors, factor U is the basis used for much of the analysis in this report. Factor U measures the level of confidence that the respondent has in the supply department.

3. Analysis

Four analysis techniques are used to analyze the response data contained in Appendix C and in Appendix D: analysis of variance between groups, rank analysis of variance within groups, categorical analysis, and partial correlation analysis. All statistical analysis in this thesis is evaluated at the .05 level of significance.

Analysis of variance between populations is not included in this report. The author concluded that the commanding officer definition of "level of confidence" is incommensurable with the Supply Corps officer definition of the same term. This conclusion was reached through partial correlation analysis and is explained in Chapter IV.

a. Analysis of Variance Between Groups

Analysis of variance (ANOVA) tests whether population group means are merely different or if one mean is statistically greater that the other mean. Figure 2-2 and Figure 3-2 list the factor means by primary groups. Figure 2-3 and Figure 3-3 summarize the analysis of between-group variance for factor U responses.

b. Rank Analysis of Variance Within Groups

Analysis of rank variance within primary groups of each population tests whether or not within-group rank means are statistically different. Again, factor U is the basis for this analysis. Figure 2-4 and Figure 3-4

summarize the analysis of rank variance within each primary group.

c. Categorical Analysis

Categorical analysis provides a non-metric method of analyzing population responses by categories. Figures 2-5, 2-6, 3-5, 3-6, 4-1, and 4-2 are crosstabulations of categorical responses.

d. Partial Correlation Analysis

Partial correlation measures the relationship between two factors and controls for other factor influences in that relationship. Figures 2-7, 3-7, and 4-3 summarize the partial correlations of factors I through T with factor U.

G. SUMMARY OF FINDINGS

More than 11 percent of the commanding officers surveyed report that the supply department is the worst of all departments within their commands. Nearly eighty-two percent of these "worst departments" are found aboard afloat commands. In addition, 21 percent of the commanding officers surveyed (see Figure 4-1) admit that if all their departments performed as does the supply department, the effectiveness of those commands would decrease at least slightly. The first finding of this thesis is that supply departments afloat have a credibility gap.

Figures 2-7 and 3-7 summarize factors that commanding officers and Supply Corps officers believe relate most to

"level of confidence". They are noticeably different. The second finding of this thesis is that commanding officers and Supply Corps officers have obviously different criterion for defining their level of confidence in the supply department.

H. ORGANIZATION OF STUDY

Chapter II of this study summarizes the analysis of commanding officer responses to Appendix A. Raw response data from commanding officers are found in Appendix C. Chapter III summarizes the analysis of Supply Corps officer responses to Appendix B. Raw response data from Supply Corps officers are found in Appendix D. Chapter IV presents the conclusions and recommendation of this thesis.

II. ANALYSIS OF COMMANDING OFFICER RESPONSES

Two hundred and one of the 312 commanding officers surveyed returned data which is used in this analysis. Another seven responses could not be used because they had at least one blank answer field. Figure 2-1 shows a summary of the major groups of commanding officers whose data is used.

GROUPS	POPULATION COMMANDING OFFICERS
AFLOAT	152
ASHORE	49
TOTAL	201
ATLANTIC FLEET	101
PACIFIC FLEET	98
NOT APPLICABLE	2
TOTAL	201
SUBMARINE	47
SURFACE	110
AVIATION	41
OTHER	3
TOTAL	201

Figure 2-1 Commanding Officer Respondents

Very few commanding officers from groups labelled "NOT APPLICABLE" and "OTHER" replied to the survey. Due to the very few replies from these groups they are not analyzed as separate groups. They include shipyards and other ashore

maintenance activities which are neither part of the Atlantic or Pacific Fleets nor members of the submarine, surface, or aviation communities. Rather, their responses are nested within and analyzed with certain ranks of the group CO.

A. COMPARISON OF FACTOR MEANS

FACTOR	FACTOR DESCRIPTION	COMMANDING OFFICER GROUPS							
		CO	COAFL	COASH	COLANT	COPAC	COSUB	COSURF	COAVI
T	Is responsive	4.50	4.95	5.04	4.95	4.86	4.98	4.87	4.85
J	Records/report	4.75	4.76	4.86	4.69	4.91	5.02	4.77	4.83
K	Keeps promises	4.86	4.88	5.00	4.69	5.03	5.00	4.50	5.02
L	Skill	4.82	4.74	5.04	4.72	4.93	5.02	4.69	4.90
M	Interfaces	4.87	4.78	5.10	4.81	4.95	4.94	4.78	5.02
N	Command Goals	5.35	5.30	5.53	5.26	5.46	5.34	5.34	5.44
O	Supports Goals	5.07	5.00	5.29	5.00	5.10	5.34	4.90	4.95
P	Morale	4.74	4.79	4.86	4.69	4.82	4.79	4.69	4.90
O	Open to change	4.69	4.55	4.82	4.88	4.61	4.79	4.50	4.88
P	Committed	5.10	4.88	5.47	5.46	5.15	5.19	5.00	5.24
S	Plans	4.59	4.55	4.71	4.50	4.89	4.63	4.50	4.61
T	Consistent	4.89	4.83	5.06	4.75	5.02	4.91	4.84	5.02
U	CO confidence	5.12	5.05	5.37	5.08	5.17	5.23	5.01	5.34

Figure 2-2 Matrix of Factor Means

Figure 2-2 is a matrix of commanding officer groups and evaluation factors. Factors I through U represent survey questions I through U respectively. (Refer to the survey of commanding officers in Appendix A) In Figure 2-2 a brief description of each factor is given immediately to the right of that factor. The numbers in the matrix blocks are the group means for each factor analyzed.

Figure 2-2 is shown to highlight the fact that between-group means are rarely ever identical. But while differences in the means shown in Figure 2-2 do exist, their group means may or may not be statistically different. These means only reflect the opinion of the specific commanding officers who were surveyed. And since they only represent a sample of the total population of the various groups of commanding officers, their means are likely different from the true population group means.

B. ANOVA BETWEEN GROUPS OF COMMANDING OFFICERS

Analysis of variance evaluates the probability that a sample mean is also the population mean. When two or more means are compared for equality, this type of analysis evaluates whether mean differences are a result of sample variations or a result of actual differences between groups.

The primary group means of survey question U from Appendix B are summarized in Figure 2-2. Those means were statistically compared with each other by analysis of variance. Figure 2-3 summarizes this comparison and

indicates which group of commanding officers have statistically different means. The null hypothesis used for Figure 2-3 states that there is no difference between group

COMMANDING OFFICER ANOVA
BETWEEN PRIMARY GROUPS

PRIMARY GROUPS	CO	COAFL	COASH	COLANT	COPAC	COSUB	COSURF	COAVI
CO								
COAFL			R					
COASH							R	
COLANT								
COPAC								
COSUB								
COSURF								
COAVI								

Figure 2-3 Analysis of Variance Between Groups

means. In terms of question U, the null hypothesis states that all groups of commanding officers have the same level of confidence in the supply department. A blank in a matrix block indicates that the null hypothesis is accepted; a "R" in a matrix block indicates that the null hypothesis is rejected.

We learn from Figure 2-3 that two sets of groups show significant mean differences. Group COASH has a statistically higher mean than either COAFL or COSURF. In terms of confidence in the supply department, COASH has a higher level of confidence than either COAFL or COSURF. All other between-group combinations have no statistical differences in their confidence in the supply department.

C. RANK ANOVA WITHIN GROUPS OF COMMANDING OFFICERS

Each primary group of commanding officers has nested within its boundaries other unique groups. These are called sub-groups. In the section B above, we saw that two sub-group comparisons of the group CO, namely COAFL and COASH, show statistically different confidence means. All primary groups listed to the right of group CO in Figure 2-3 could actually be considered sub-groups of the larger population CO. These sub-groups can be further subdivided into smaller groups known as ranks. The last section discussed differences <u>between</u> groups; this section reports on differences <u>within</u> those same groups. Figure 2-4 is a matrix which summarizes within group analysis of variance just as the between-group analysis of variance was summarized in Figure 2-3.

SURVEY QUESTION	COMMANDING OFFICER SUB-GROUPS ANOVA BY RANKS								
	SUB-GROUPS	GROUPS							
		CO	COAFL	COASH	COLANT	COPAC	COSUB	COSURF	COAVI
A	Command type	R							
B	Fleet								
C	Community			R					
D	Command size					R			
F	CO rank						R		
F	SO rank	R				R		R	
G	Number of SO								
H	CO years								
V	Best dept.	R	R		R	R	R		
W	Worst dept.	R	R		R	R		R	
X	What if ...	R	R	R	R	R	R	R	R
Y	Eval. method								

Figure 2-4 Rank Analysis Within Commanding Officer Groups

As before, the analysis of variance is based on answers to survey question U. The null hypothesis in this case states that there are no significant mean differences due to ranks within any primary group of commanding officers. (Primary groups of commanding officers are always prefixed by "CO") A blank in a matrix block indicates that the null hypothesis is accepted; a "R" in a matrix block indicates that the null hypothesis is rejected.

The following observations refer to groups within which the hypothesis is rejected. The term "mean" as used below always refers to the level of confidence the commanding officer has in his supply department.

1. Command Type

A significant difference in means exists between groups COAFL and COASH. Group COASH has the highest level of confidence in the supply department.

2. Community

Group COASH has a significant difference in means between the submarine and surface communities. The mean of the submarine community is statistically higher than the mean of the surface community.

3. Command Size

Confidence level means are statistically different due to command size within the group COPAC. Here the commanding officers whose commands are greater than 1,000 in

size have a mean which is statistically higher than those whose commands are between 200 and 499 in size.

4. Commanding Officer Rank

The group COSUB is the only group which shows a mean difference due to the rank of the commanding officer. Within this group the confidence level of captains is statistically higher than the confidence level of commanders.

5. Supply Officer Rank

Groups CO, COPAC, and COSURF show that the mean confidence level of the commanding officer is significantly affected by the rank of the supply officer. Within these groups, and other groups, commands whose senior supply officers are Supply Corps commanders draw the highest average levels of credibility. Within any group, commands whose senior supply officers are Supply Corps lieutenant commanders draw the lowest average levels of credibility.

6. Best Department

Within groups CO, COAFL, COLANT, COPAC, and COSUB the confidence level means are very dependent on whether or not the commanding officer views the supply department as his best department. Within groups CO and COAFL, commanding officers who evaluate either the weapons or the engineering departments as the best departments have a statistically lower level of confidence in the supply department. Within group COLANT the same is true only when the weapons

CROSSTABULATION OF
COMMANDING OFFICER RESPONSES
TO SURVEY QUESTION V

GROUP	TOTAL		PERCENT	
	RESPONDENTS	SAY SUPPLY = BEST	OF TOTAL RESPONDENTS SAY SUPPLY = BEST	DISTRIBUTION OF SUPPLY = BEST WITHIN GROUPS
AFLOAT	152	22	10.9%	66.7%
ASHORE	49	11	5.5%	33.3%
TOTAL	201	33	16.4%	100.0%
ATLANTIC	101	16	7.9%	48.5%
PACIFIC	98	17	8.5%	51.5%
NOT APPLICABLE	2	0	0.0%	0.0%
TOTAL	201	33	16.4%	100.0%
SUBMARINE	47	9	4.5%	27.3%
SURFACE	110	17	8.5%	51.5%
AVIATION	41	6	3.0%	18.2%
OTHER	3	1	0.4%	3.0%
TOTAL	201	33	16.4%	100.0%

Figure 2-5 Best Department is the Supply Department

department is selected as the best. Within COPAC and COSUB this is true only when the engineering department is selected as the best department. Otherwise, the commanding officer's choice of the best department has no significant impact on his confidence in the supply department.

Figure 2-5 shows a crosstabulation of commanding officer group responses to survey question V. This question reads: "My best department is the (___) department". Only the responses which identify the supply department as the best department are tabulated.

7. Worst Department

Unless the worst department is the supply department, there is no significant mean difference within the ranks of any commanding officers groups However, when the supply department is selected as the worst, groups CO, COAFL, and COSURF show a statistical difference between the supply and all other departments. Groups COLANT and COPAC show that the supply and repair/maintenance/production department means are statistically equal. Here, when repair/maintenance/production department is selected as the worst, the mean is not statistically different from when the supply department is selected as the worst department.

Figure 2-6 is a crosstabulation of group responses to survey question W. The question reads: "The worst department at my command is the (___) department". Only the

CROSSTABULATION OF
COMMANDING OFFICER RESPONSES
TO SURVEY QUESTION W

GROUP	TOTAL		PERCENT	
	RESPONDENTS	SAY SUPPLY =WORST	OF TOTAL RESPONDENTS SAY SUPPLY =WORST	DISTRIBUTION OF SUPPLY = WORST WITHIN GROUPS
AFLOAT	152	19	9.4%	82.6%
ASHORE	49	4	2.0%	17.4%
TOTAL	201	23	11.4%	100.0%
ATLANTIC	101	14	7.0%	60.9%
PACIFIC	98	8	4.0%	34.8%
NOT APPLICABLE	2	1	0.4%	4.3%
TOTAL	201	23	11.4%	100.0%
SUBMARINE	47	6	3.0%	26.1%
SURFACE	110	10	5.0%	43.5%
AVIATION	41	7	3.4%	30.4%
OTHER	3	0	0.0%	0.0%
TOTAL	201	23	11.4%	100.0%

Figure 2-6 Worst Department is the Supply Department

replies which identify the supply department as the worst department are tabulated.

8. What If

All groups of commanding officers report that if all departments performed as does the supply department the performance of the whole command would decrease as their level of confidence in the supply department decreased. The means become statistically different between the group rank extremes.

D. PARTIAL CORRELATION OF FACTORS ANALYSIS

Each group factor (survey question) I through T was correlated against factor U by partial correlation analysis. The results were ordered from one to 12 (highest positive correlation to lowest positive or negative correlation) within each respective group. Figure 2-7 summarizes that ordering. Partial correlation measures the relationship between two factors while controlling for possible effects of other factors. Partial correlation is often used to uncover hidden relationships between many combinations of other factors. Figure 2-7 summarizes and compares the relative weight each commanding officer group gives to factors I through T. The lowest numbers in the matrix denote the highest positive weights. Negative correlations are identified by an asterisk.

FACTOR	DESCRIPTION	GROUPS							
		CO	COAFL	COASH	COLANT	COPAC	COSUB	COSURF	COAVI
I	Is responsive	9	10	9*	10*	7	8	11*	1
J	Records/report	7	8	8	1	11*	7	9	7
K	Keeps promises	10	9	7	12*	8	12*	3	9*
L	Skill	8	9	9	7	8	8	5	8
M	Interface	11	11	11*	8	12*	10*	7	12*
N	Command goals	8	7	8	8	10*	2	8	8
Q	Supports goals	3	1	12*	5	8	9*	1	10*
P	Morale	8	8	10*	8	8	8	1	11
Q	Open to change	8	9	1	2	9	4	10	4
R	Committed	12	12	4	11*	5	11*	12*	3
S	Plans	1	2	5	3	3	1	2	5
T	Consistent	5	6	6	9	1	5	6	6

Figure 2-7 Partial Correlation of Factors Against Factor U

III. ANALYSIS OF SUPPLY CORPS OFFICER RESPONSES

One hundred and eighty-seven of the 312 Supply Corps Officers surveyed returned surveys which is used in this analysis. Another eleven responses could not be used because they had at least one blank answer field. Figure 3-1 shows a summary of the major groups of Supply Corps officers whose data is used.

GROUPS	POPULATION
	SUPPLY OFFICERS
AFLOAT	134
ASHORE	53
TOTAL	187
ATLANTIC FLEET	94
PACIFIC FLEET	83
NOT APPLICABLE	10
TOTAL	187
SUBMARINE	51
SURFACE	88
AVIATION	40
OTHER	8
TOTAL	187

Figure 3-1 Supply Corps Officer Respondents

Although more Supply Corps officers than commanding officers from groups labelled "NOT APPLICABLE" and "OTHER" responded, the number of replies from these groups is still

insufficient for good data analysis. Therefore, they are not analyzed as separate groups. They include Supply Corps officers from maintenance activities which are neither part of the Atlantic or Pacific Fleets, nor members of the submarine, surface, or aviation communities. Their data is nested within and analyzed with certain ranks of group SO

A. COMPARISON OF FACTOR MEANS

Figure 3-2 is a matrix of Supply Corps officer groups and evaluation factors. Factors I through U represent survey questions I through U respectively. (Refer to the survey of Supply Corps officers in Appendix B) A brief description of each factor is given immediately to the right of that factor. The numbers in the matrix blocks are the group means for each factor analyzed.

Figure 3-2 is shown to highlight the fact that between-group means are rarely ever identical. But while differences in the means shown in Figure 3-2 do exist, their group means may or may not be statistically different. These means only reflect the opinion of the specific Supply Corps officers surveyed. And, since they only represent a sample of the total population of the various groups of Supply Corps officers, their means are likely different from the true population group means.

B. ANOVA BETWEEN GROUPS OF SUPPLY CORPS OFFICERS

Analysis of variance evaluates the probability that a sample mean is also the population mean. When two or more means are compared for equality, this type of analysis

FACTOR	FACTORS DESCRIPTION	SUPPLY CORPS OFFICER GROUPS							
		SO	SOAFL	SOASH	SOLANT	SOPAC	SOSUB	SOSURF	SOAVI
I	Is responsive	4.88	4.88	4.85	4.42	4.88	5.06	4.80	4.47
J	Records/report	4.63	4.71	4.68	4.92	4.93	4.88	4.63	4.88
R	Keeps promises	5.11	5.13	5.06	5.01	5.20	5.39	4.87	5.05
L	Skill	4.47	4.47	4.48	4.35	4.63	4.80	4.22	4.48
M	Interfaces	4.79	4.78	4.41	4.72	4.88	4.88	4.63	4.85
N	Command Goals	5.25	5.25	5.20	5.20	5.31	5.35	5.23	5.10
O	Supports Goals	5.20	5.25	5.34	5.17	5.40	5.47	5.20	5.18
R	Morale	4.80	4.79	4.66	4.26	4.51	4.41	4.22	4.98
O	Open to change	4.44	4.40	4.55	4.37	4.50	4.47	4.35	4.48
R	Committed	5.13	5.10	5.21	5.02	5.24	5.17	5.11	5.13
S	Plans	4.43	4.42	4.47	4.20	4.79	4.63	4.34	4.42
I	Consistent	4.78	4.72	4.92	4.68	4.87	4.98	4.80	4.85
U	CO confidence	5.14	5.11	5.23	5.04	5.25	5.33	4.98	5.20

Figure 3-2 Matrix of Factor Means

evaluates whether mean differences are a result of sample variations or a result of actual differences between groups.

The primary group means of survey question U from Appendix B are summarized in Figure 3-2. The means were statistically compared with each other by analysis of variance.

SUPPLY CORPS OFFICER ANOVA
BETWEEN PRIMARY GROUPS

PRIMARY GROUPS	SO	SOAFL	SOASH	SOLANT	SOPAC	SOSUB	SOSURF	SOAVI
SO								
SOAFL								
SOASH								
SOLANT								
SOPAC								
SOSUB							R	
SOSURF								
SOAVI								

Figure 3-3 Analysis of Variance Between Groups

Figure 3-3 summarizes this comparison and indicates which groups of Supply Corps officers have statistically

different means. The null hypothesis for Figure 3-3 states that there is no difference between group means. In terms of question U, the null hypothesis states that all groups of Supply Corps officers have the same level of confidence in the supply department. A blank in a matrix block indicates that the null hypothesis is accepted; a "R" in a matrix block indicates that the null hypothesis is rejected.

We learn from Figure 3-3 that only one comparison of means is rejected. Specifically, groups SOSUB and SOSURF show a statistical difference in means. In term of survey question U, this tells us that SOSUB Supply Corps officers have a statistically higher level of confidence in the supply department than do SOSURF Supply Corps officers.

C. RANK ANOVA WITHIN GROUPS OF SUPPLY CORPS OFFICERS

Each primary group of Supply Corps officers has nested within its boundaries other unique groups. These are called sub-groups. In section B above we saw that two sub-groups of the group SO, namely SOSUB and SOSURF have statistically different means. Again, all the groups listed to the right of group SO can be considered sub-groups of the larger population SO. These sub-groups can be further subdivided into smaller groups known as ranks. In the last section we looked for differences <u>between</u> groups; in this section we will look for differences <u>within</u> those same groups. Figure 3-4 is a matrix which summarizes the within-group analysis.

SURVEY QUESTION	SUPPLY CORPS OFFICER SUB-GROUPS ANOVA BY RANKS								
	SUB-GROUPS	GROUPS							
		SO	SOAFL	SOASH	SOLANT	SOPAC	SOSUB	SOSURF	SOAVI
A	Command type								
B	Fleet								
C	Community				R				
D	Command size		R		R				
E	CO rank								
E	SO rank								R
G	Number of SO								
H	CO years								R
V	Best dept.	R	R			R			
W	Worst dept.	R	R		R			R	R
X	What if ...	R	R		R			R	R
Y	Eval. method	R	R		R				

Figure 3-4 Rank Analysis Within Supply Corps Officer Groups

As before, the analysis of variance is based on answers to survey question U. The analysis null hypothesis states that there is no significant mean differences due to ranks within any primary group of Supply Corps officers. (Primary groups of Supply Corps officers are always prefixed by "SO") Figure 3-4 refers to ranks by survey question number. Appendix B provides more detail about the rank identities. And, as before, a blank or a "R" within a matrix block respectively indicates either acceptance or rejection of the null hypothesis.

The following observations refer to groups within which that hypothesis is rejected. The term "mean" as used below always refers to the confidence the Supply Corps officer has in his supply department.

1. Community

Within the group SOLANT the submarine community has a statistically higher mean that the surface community.

2. Command Size

Within groups SOAFL and SOLANT, supply officers of activities which have more than 1,000 persons have a statistically higher mean than those of activities which have only 500 to 999 persons.

3. Supply Officer Rank

Group SOAVI has statistical differences in means due to the rank of the supply officer. Within this group, the

Supply Corps commanders report a statistically higher mean than Supply Corps lieutenants.

4. Commanding Officer Commissioned Years

Group SOAVI registers significant within-group mean differences due to the number of years the commanding officer has been commissioned. Supply Corps officers whose commanding officers have been commissioned 24 or 25 years have a significantly higher mean that those whose commanding officers have been commissioned only 18 years.

5. Best Department

Within groups SO, SOAFL, and SOPAC, those Supply Corps officers who rated the supply department as the best department at their commands reported a significantly higher mean than some of those who did not. Specifically, those Supply Corps officers had significantly higher means than those who rated the weapons or engineering department as the best department.

Figure 3-5 shows a crosstabulation of Supply Corps officer responses to survey question V. The question reads: "The best department at my command is the (___) department". Only the responses which identify the supply department as the best department are tabulated.

6. Worst Department

Unless the worst department is the supply department, group SO shows no significant differences in means based on which one is considered the worst department.

CROSSTABULATION OF
SUPPLY CORPS OFFICER RESPONSES
TO SURVEY QUESTION V

GROUP	TOTAL		PERCENT	
	RESPONDENTS	SAY SUPPLY = BEST	OF TOTAL RESPONDENTS SAY SUPPLY = BEST	DISTRIBUTION OF SUPPLY = BEST WITHIN GROUPS
AFLOAT	134	82	43.8%	71.9%
ASHORE	53	32	17.2%	28.1%
TOTAL	187	114	61.0%	100.0%
ATLANTIC	94	53	28.3%	46.5%
PACIFIC	83	53	28.3%	46.5%
NOT APPLICABLE	10	8	4.4%	7.0%
TOTAL	187	114	61.0%	100.0%
SUBMARINE	51	32	17.1%	28.1%
SURFACE	88	52	27.8%	45.6%
AVIATION	40	23	12.3%	20.2%
OTHER	8	7	3.8%	6.1%
TOTAL	187	114	61.0%	100.0%

Figure 3-5 The Best Department Is The Supply Department

CROSSTABULATION OF
SUPPLY CORPS OFFICER RESPONSES
TO SURVEY QUESTION W

GROUP	TOTAL		PERCENT	
	RESPONDENTS	SAY SUPPLY =WORST	OF TOTAL RESPONDENTS SAY SUPPLY =WORST	DISTRIBUTION OF SUPPLY = WORST WITHIN GROUPS
AFLOAT	134	6	3.2%	100.0%
ASHORE	53	0	0.0%	0.0%
TOTAL	187	6	3.2%	100.0%
ATLANTIC	94	5	2.7%	84.4%
PACIFIC	83	1	0.5%	15.6%
NOT APPLICABLE	10	0	0.0%	0.0%
TOTAL	187	6	3.2%	100.0%
SUBMARINE	51	2	1.1%	34.4%
SURFACE	88	3	1.6%	50.0%
AVIATION	40	1	0.5%	15.6%
OTHER	8	0	0.0%	0.0%
TOTAL	187	6	3.2%	100.0%

Figure 3-6 The Worst Department Is The Supply Department

When the supply department is selected as the worst, its mean is significantly lower than any other selection.

Within groups SOAFL, SOLANT, SOSURF, and SOAVI, when the supply department is selected as the worst department its means are statistically lower than any department except the repair/production/maintenance department. Group SOAVI shows and additional direct correlation between the supply department and the weapons department.

Figure 3-6 is a crosstabulation of group responses to survey question W. The question reads: "The worst department at my command is the (___) department". Only the replies which identified the supply department as the worst department are tabulated.

7. What If

Within groups SO, SOAFL, SOLANT, SOSURF, and SOAVI Supply Corps officers report that the performance of the command would decrease as their confidence in the supply department decreases. The means for these ranks becomes statistically large between the extremes.

8. Evaluation Method

Three groups report that the method the Supply Corps officer uses to evaluate the departments at his command make a statistical difference in his confidence in the supply department. Here, his confidence is statistically higher if he bases his evaluation on inspection results rather than

"other reason". Between these extremes his confidence decreases from "day-to-day performance" to "intuition".

D. PARTIAL CORRELATION OF FACTORS

Each group factor (survey question) I through T was correlated against factor U by partial correlation analysis. The results were ordered from one to 12 (highest positive correlation to lowest positive or negative correlation) within each respective group. Figure 3-7 summarizes that ordering. Partial correlation measures the relationship between two factors while controlling for possible effect of other factors. Partial correlation is often used to uncover hidden relationships between many combinations of factors. Figure 3-7 summarizes and compares the relative weight the different Supply Corps officer groups give to factors I through T. The lowest numbers in the matrix denote the highest positive weights. Negative correlations are identified by an asterisk.

FACTOR	DESCRIPTION	GROUPS							
		SO	SOAFL	SOASH	SOLANT	SOPAC	SOSUB	SOSURF	SOAVI
I	Is responsive	8	8	10	12*	7	2	12*	2
J	Records/report	1	1	5	1	1	12*	1	1
K	Keeps promises	10	10	8	8	12*	3	8	8
L	Skill	3	2	8	3	8	3	2	12*
M	Interface	7	8	3	3	3	8	3	7
N	Command goals	12*	12*	7	10	11	11*	11*	8
Q	Supports goals	8	11*	2	5	3	7	3	3
P	Morale	11	7	12*	11*	5	10*	10	9*
Q	Open to change	8	8	11*	8	10	5	6	11*
K	Committed	8	3	1	7	2	1	4	10*
S	Plans	5	4	9	8	6	4	7	5
T	Consistent	2	5	1	2	8	6	5	4

Figure 3-7 Partial Correlation of Factors Against Factor U

IV. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The conclusion of this research paper is that the supply department within the maintenance environment has a credibility problem. Figure 4-1 graphically highlights one

COMMAND EFFECTIVENESS WOULD:	POPULATION	
	COMMANDING OFFICERS	SUPPLY CORPS OFFICERS
INCREASE AT LEAST SLIGHTLY	118 (58.7%)	162 (86.6%)
REMAIN THE SAME	41 (20.4%)	16 (8.6%)
DECREASE AT LEAST SLIGHTLY	42 (20.9%)	9 (4.8%)
TOTAL	201 (100.0%)	187 (100.0%)

Figure 4-1 Supply Department Impact

basis for this conclusion. Twenty-one percent (42 commanding officers) of all commanding officers surveyed admit that if all their departments performed as does the supply department, the performance of their command would decrease at least slightly. This is analogous to saying that one fifth of the supply departments perform below the command average for all departments. Chapter II (see Figure 2-6) reports that 11.4 percent of commanding officer

respondents consider the supply department the worst department at their command.

The conclusion stated above is moderated in that the supply department compares very well against the other departments listed in Appendices A and B in terms percentage of "best" and "worst". Overall, commanding officers rate the supply department second only to the engineering department when they evaluate the "best" department. They also rate all departments except the repair/maintenance department "worse" than the supply department. Figure 4-2 summarizes the departments which are selected as the "best" and "worst". Each number in the matrix represents the percentage of either commanding officers or Supply Corps officers who chose the applicable department.

DEPARTMENT	COMMANDING OFFICER		SUPPLY CORPS OFFICER	
	BEST	WORST	BEST	WORST
OPERATIONS	14.9%	26.4%	7.5%	15.5%
WEAPONS	14.9%	12.4%	8.6%	13.4%
SUPPLY	16.4%	11.4%	61.0%	3.2%
REPAIR/MAINT	10.9%	2.5%	5.3%	7.0%
ENGINEERING	24.4%	11.9%	7.0%	22.5%
ADMIN	3.0%	18.4%	3.7%	18.7%
"OTHER"	15.4%	16.9%	7.0%	19.8%

Figure 4-2 Best and Worst Departments

Chapter II reports that the supply departments run by Supply Corps commanders have the highest average level of commanding officer confidence. However, commanders rival lieutenants in terms of which Supply Corps rank has the highest percentage of "worst" departments. Each of these ranks has roughly one third of the 23 "worst" departments. Chapter II also states that the performance of Supply Corps commanders is statistically higher than the performance of lieutenant commanders. Categorical analysis neither confirms nor discredits that finding. Categorical analysis does indicate that Supply Corps commanders head a higher number of both "best" and "worst" supply departments than do lieutenant commanders.

Of the 42 supply departments which would decrease the overall performance of their commands (if all other departments onboard performed as they do), nearly 83 percent are found onboard afloat commands. These are equally well distributed between the Atlantic and Pacific Fleets and tend to amass within the surface community.

Nearly two out of three (61 percent) of the Supply Corps officers who responded to the survey claim to have the best department onboard. This total is nearly four times higher than the number of commanding officers who credit the supply department with being the best.

Perhaps the most significant finding of this research is that commanding officers and Supply Corps officers have very

different perceptions of which factors contribute the most to "level of confidence" (credibility). Figure 4-3 shows

FACTOR	DESCRIPTION	POPULATION		
		SO		CO
I	Is responsive	4		9
J	Records/reports	4		7
R	Keeps promises	10		10
L	Skill	9		2
M	Interface	7		11
N	Command goals	12*		4
Q	Supports goals	9		9
R	Morale	11		4
Q	Open to change	9		4
R	Committed	4		12
S	Plans	5		1
T	Consistent	2		5

Figure 4-3 Correlation Differences

how commanding officers and Supply Corps officers differ in their definition of "level of confidence". Figure 4-3 iterates the partial correlation analysis of Figures 2-7 and 3-7 for commanding officers and Supply Corps officers. As

before, the numbers in the matrix represent the relative weight given to each factor. The number one is the highest positive correlation, the number 12 is the lowest positive or negative correlation. Negative correlation are identified by an asterisk.

This discovery may give merit to the traditional line officer accusation that Supply Corps officers "march to the beat of a different drummer". Twenty-one percent of the commanding officers surveyed report that their supply departments do not keep step with the requirements of the maintenance environment. One cannot help but wonder how many Supply Corps officers from those same activities responded to the survey and said that their supply department was the best department onboard.

B. RECOMMENDATIONS

This research paper establishes that 21 percent of the commanding officers surveyed are not satisfied with the performance of their supply departments. It also suggests that many Supply Corps officers may not even be aware that perhaps their department suffers a credibility gap with their commanding officer.

The Naval Supply Systems Command needs to pursue steps to independently validate the conclusions of this thesis. If that investigation confirms these findings, the Naval Supply Systems Command may choose to:

(1) Assess the effects and costs of this credibility gap.

(2) Sponsor frank dialog with commanding officers from the various maintenance communities. These discussions should focus on identifying sources of, and solutions to, the credibility gap.

(3) Fully research the commanding officer's definition of credibility and incorporate that perspective into the formal training of all Supply Corps officers.

(4) Recommend that the text of a department head's fitness reports include a ranking of that department head relative to all department heads onboard, regardless of their designators. Under current fitness report rules the performance of the Supply Corps officer is never formally compared against the performance of his non-Supply Corps counterparts.

APPENDIX A

COMMANDING OFFICER EVALUATION OF THE SUPPLY DEPARTMENT

Questions A through F below ask for general background information about your command. Please place the number of the most correct alternative in the space (___) provided.

A. Command type: (___)
   (1) Afloat
   (2) Ashore

B. Fleet: (___)
   (1) Atlantic
   (2) Pacific
   (3) Not applicable

C. Community: (___)
   (1) Submarine
   (2) Surface
   (3) Aviation
   (4) Other

D. Command size: (___)
   (1) 99 or less
   (2) Between 100 and 199
   (3) Between 200 and 499
   (4) Between 500 and 999
   (5) Greater than 1000

E. Your current rank: (___)
   (1) Lieutenant or below
   (2) Lieutenant Commander
   (3) Commander
   (4) Captain
   (5) Flag

F. Rank of the <u>senior</u> Supply Corps officer assigned: (___)
   (1) Lieutenant(JG) or below
   (2) Lieutenant
   (3) Lieutenant Commander
   (4) Commander
   (5) Captain

Questions G and H below require that you provide the information requested in the space (___) provided.

G. Number of Supply Corps officers at your command (___)

H. Your number of commissioned years service (___)

Factors I through U below refer specifically to the Supply Department at your command. Below each factor is a scale which ranges from 0 to 6. For each factor, please rate the performance of the Supply Department relative to that factor by circling the most correct number on the scale. In this section, 0 is the least favorable and 6 is the most favorable.

I. Timeliness in responding to customer needs

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

J. Accuracy of the department's records and reports

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

K. Degree to which promises made are kept

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

L. Level of professional skill within the department

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

M. Degree of favorable interface with customer departments

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

N. Degree to which <u>stated</u> department goals support command goals

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

O. Degree to which department <u>actions</u> support command goals

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

P. Level of positive morale within the department

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

Q. The department's openness to change

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

R. The department's commitment to customer service

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

S. Degree of advanced planning (rather than crisis management) done within the Supply Department

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

T. Degree to which the department is consistent in its performance

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

U. How much confidence do you have in the Supply Department?

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

Statements V through Y require that you complete the sentence by placing the number of the alternative chosen in the space (___) provided.

V. My best department is the (___) department.

(1) Operations
(2) Weapons
(3) Supply
(4) Repair/Production/Maintenance
(5) Engineering
(6) Administration
(7) Other _____(please specify)

W. My worst department is the (___) department.

(1) Operations
(2) Weapons
(3) Supply
(4) Repair/Production/Maintenance
(5) Engineering
(6) Administration
(7) Other _____(please specify)

X. If all my departments performed as does the Supply Department, the overall performance of my command would (___).

(1) Improve significantly
(2) Improve slightly
(3) Remain the same
(4) Decline slightly
(5) Decline significantly

Y. My answers to statements V through X above are based primarily on (___). (Please select only one response)

(1) Inspection results
(2) Day-to-day performance of those departments
(3) Intuition
(4) Other reasons

APPENDIX B

SUPPLY OFFICER EVALUATION OF THE SUPPLY DEPARTMENT

Questions A through F below ask for general background information about your command. Please place the number of the most correct alternative in the space (___) provided.

A. Command type: (___)
   (1) Afloat
   (2) Ashore

B. Fleet: (___)
   (1) Atlantic
   (2) Pacific
   (3) Not applicable

C. Community: (___)
   (1) Submarine
   (2) Surface
   (3) Aviation
   (4) Other

D. Command size: (___)
   (1) 99 or less
   (2) Between 100 and 199
   (3) Between 200 and 499
   (4) Between 500 and 999
   (5) Greater than 1000

E. Rank of your Commanding Officer (___)
   (1) Lieutenant or below
   (2) Lieutenant Commander
   (3) Commander
   (4) Captain
   (5) Flag

F. Your current rank: (___)
   (1) Lieutenant(JG) or below
   (2) Lieutenant
   (3) Lieutenant Commander
   (4) Commander
   (5) Captain

Questions G and H below require that you provide the information requested in the space (___) provided.

G. Number of Supply Corps officers at your command (___)

H. Your Commanding Officer's number of commissioned years service (___)

Factors I through U below refer specifically to the Supply Department at your command. Below each factor is a scale which ranges from 0 to 6. For each factor, please rate the performance of the Supply Department relative to that factor by circling the most correct number on the scale. In this section, 0 is the least favorable and 6 is the most favorable.

I. Timeliness in responding to customer needs

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

J. Accuracy of the department's records and reports

```
----+----+----+----+----+----+
0    1    2    3    4    5    6
```

K. Degree to which promises made are kept

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

L. Level of professional skill within the department

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

M. Degree of favorable interface with customer departments

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

N. Degree to which <u>stated</u> department goals support command goals

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

O. Degree to which department <u>actions</u> support command goals

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

P. Level of positive morale within the department

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

Q. The department's openness to change

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

R. The department's commitment to customer service

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

S. Degree of advanced planning (rather than crisis management) done within the Supply Department

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

T. Degree to which the department is consistent in its performance

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

U. How much confidence do you have in the Supply Department?

```
+----+----+----+----+----+----+
0    1    2    3    4    5    6
```

Statements V through Y require that you complete the sentence by placing the number of the alternative chosen in the space (___) provided.

V. The best department at my command is the (___) department.

(1) Operations
(2) Weapons
(3) Supply
(4) Repair/Production/Maintenance
(5) Engineering
(6) Administration
(7) Other _____(please specify)

W. The worst department at my command is the (___) department.

(1) Operations
(2) Weapons
(3) Supply
(4) Repair/Production/Maintenance
(5) Engineering
(6) Administration
(7) Other _____(please specify)

X. If all the departments performed as does the Supply Department, the overall performance of my command would (___).

(1) Improve significantly
(2) Improve slightly
(3) Remain the same
(4) Decline slightly
(5) Decline significantly

Y. My answers to statements V through X above are based primarily on (___). (Please select only one response)

(1) Inspection results
(2) Day-to-day performance of those departments
(3) Intuition
(4) Other reasons

APPENDIX C

COMMANDING OFFICER RESPONSES

This appendix contains the raw data which was returned by commanding officers who responded to the survey found in Appendix A.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	1	1	2	3	1	1	20	6	4	5	5	4	5	6	4	5	5	5	5	5	5	1	3	1
1	1	1	2	3	1	1	18	5	5	5	5	5	6	5	4	3	5	4	5	4	5	3	4	2
1	1	1	2	3	1	1	16	4	5	5	4	3	6	6	5	5	6	5	5	6	2	1	3	2
1	1	1	3	3	2	2	19	5	6	5	5	4	5	5	4	4	5	5	5	5	5	2	2	1
1	1	1	2	3	1	1	22	5	5	6	5	6	6	6	5	6	5	6	5	6	5	2	2	1
1	1	1	2	3	2	1	19	4	3	4	4	3	5	5	4	4	4	3	4	4	5	2	4	1
1	1	1	2	3	1	1	16	5	5	6	6	6	6	5	5	5	6	5	5	6	7	5	2	1
1	1	1	3	3	2	2	17	5	5	5	5	5	6	5	4	3	5	5	4	5	2	5	2	2
1	1	1	5	4	4	11	23	4	3	5	4	5	5	4	4	5	3	4	3	5	2	3	3	3
1	1	1	2	3	1	1	19	6	5	5	5	5	6	6	6	6	5	5	6	6	5	1	3	2
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
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APPENDIX D

SUPPLY OFFICER RESPONSES

This appendix contains raw data which was returned by Supply Corps officers who responded to the survey found in Appendix B.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
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APPENDIX E

LIST OF TERMS AND DEFINITIONS

ANOVA	Analysis of variance
CO	All commanding officer respondents
COAFL	Commanding officers of afloat commands
COASH	Commanding officers of ashore commands
COAVI	Commanding officers of afloat and ashore commands within the aviation community
COLANT	Commanding officers of afloat and ashore commands within the Atlantic Fleet
COPAC	Commanding officers of afloat and ashore commands within the Pacific Fleet
COSUB	Commanding officers of afloat and ashore commands within the submarine community
COSURF	Commanding officers of afloat and ashore commands within the surface community
SO	All Supply Corps officer respondents
SOAFL	Supply Corps officers of afloat commands
SOASH	Supply Corps officers of ashore commands
SOAVI	Supply Corps officers of afloat and ashore commands within the aviation community
SOLANT	Supply Corps officers of afloat and ashore commands within the Atlantic Fleet
SOPAC	Supply Corps officers of afloat and ashore commands within the Pacific Fleet
SOSUB	Supply Corps officers of afloat and ashore commands within the submarine community
SOSURF	Supply Corps officers of afloat and ashore commands within the surface community

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